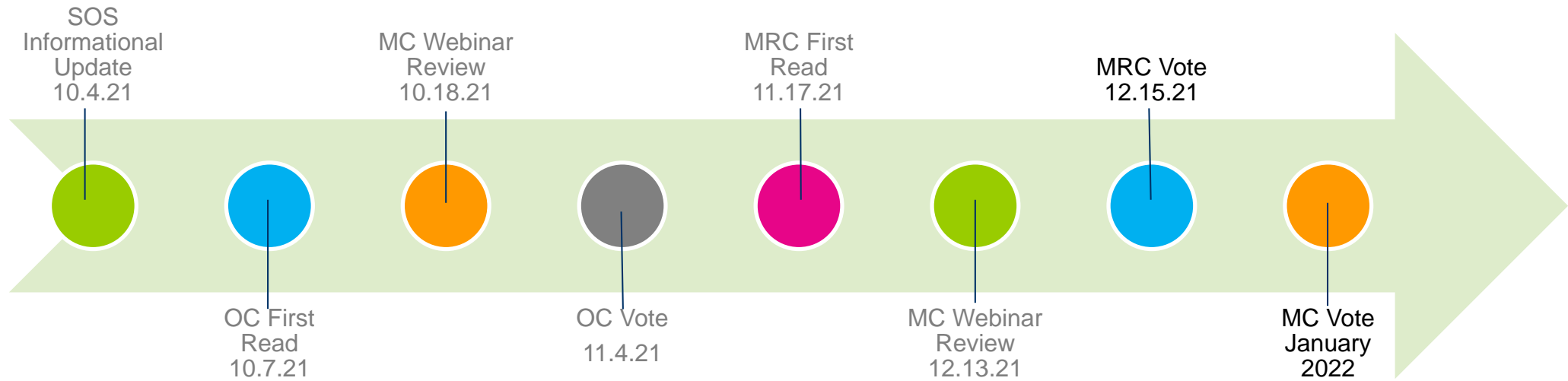




# Intelligent Reserve Deployment PJM Package - SRDTF

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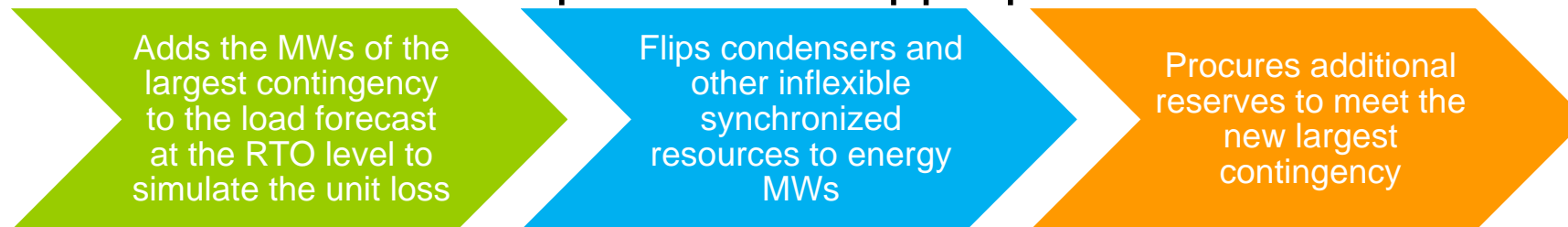
- Formally introduced at September, 2020 OC.
  - Effort discussed at high levels in prior committee meetings
- SRDTF established in March, 2021 reporting to the OC.
  - 7 meetings: April through September 2021
  - 70-80 participants on average per meeting
  - Reviewed education and analysis based on real events
  - Generated PJM (IRD) and IMM packages
- PJM IRD Package endorsement at November, 2021 OC.
  - Preferred over status quo and IMM package



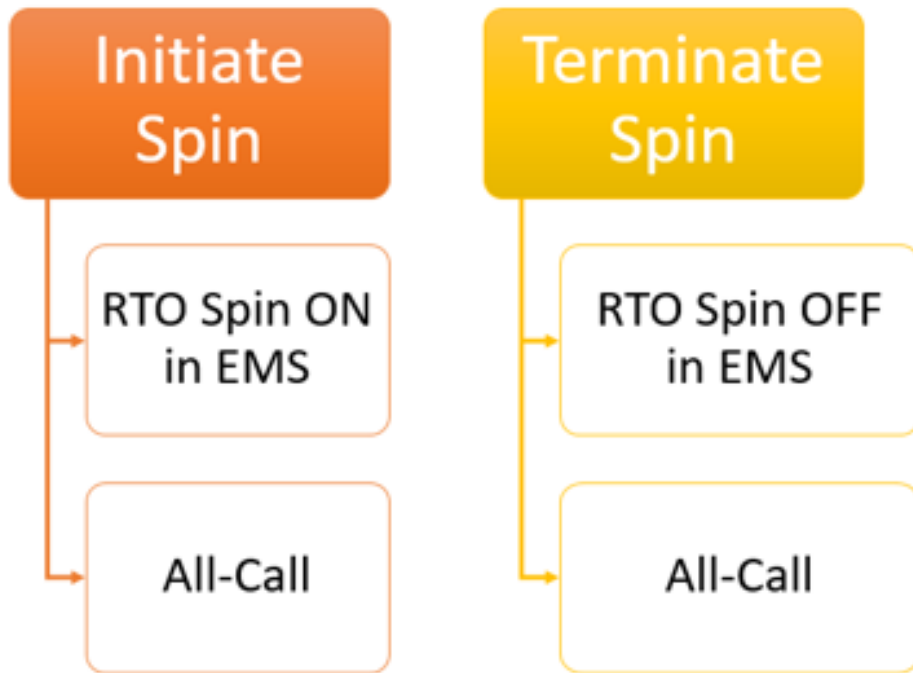
- Scope of SRDTF around deployment of reserves during a Synchronized Reserve Event.
  - Initiation mechanism and communications
  - Constraint control during events
  - Pricing the conversion of reserves to energy
  - Ease of transition in and out of events
  - Performance evaluation of using SCED
- Reserve clearing/estimation and pricing covered by other efforts and were out of scope.
- PJM package works under current reserve procurement rules and flexible to adapt to upcoming changes.

- Synchronized reserve events are emergency procedures triggered by PJM to maintain grid reliability in accordance with NERC BAL standards.
  - Caused by a variety of conditions including loss of generation and sudden influx of load
- An All-Call message is sent to units with an instruction to raise to full output.
  - Free for all deployment with only MAD/RTO granularity
  - Inconsistent response leads to periods of under and over-response
- RTSCED cases are not consistently used during an event.
  - Cases that align with dispatch instructions are not readily available
  - Misaligned/opposing pricing and dispatch instructions
  - Limited visibility into expected response and constraint impacts

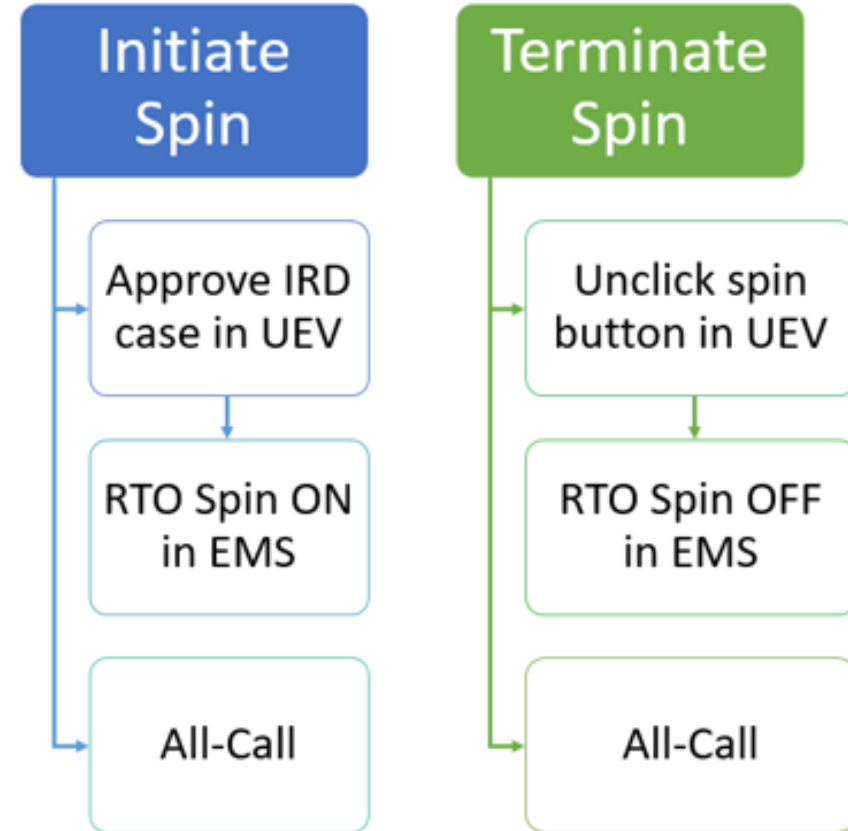
- Intelligent Reserve Deployment (IRD)
  - IRD is a SCED case that simulates the loss of the largest generation contingency. Approval of the case will trigger a deployment event.
    - Economic dispatch based on real-time input including constraints
    - Converts inflexible reserve MWs to energy
    - Readily available for use, no lag time
    - Initiates faster response until appropriate RTSCED case available



## Current Process



## IRD Process



- Updated economic basepoints to replace all-call instructions.
  - All-call will still go out for communication purposes
- Active constraints will be controlled by IRD.
  - Target resources that do not adversely impact constraints
- IRD instructions will be priced in the subsequent interval.
  - Supersedes approved RTSCED cases for the same interval
- Dynamic performance evaluations based on event dispatch.
  - Removal of resource aggregation within a portfolio
  - Status quo for Demand Response
- Smooth transition in and out of events with continued SCED usage
  - Updated basepoints to reduce manual actions required



- Largest contingency is basis for reserve requirement.
- MW value of largest resource can fluctuate by hundreds of MWs.
  - Less than status quo of deploying all available reserves
- Amount of available reserve MWs can vary by thousands of MWs.
  - Usage of a static percentage based approach may fall short
- Majority of events not triggered by loss of largest contingency.
  - Ability to modify MW value used based on event experience

- **In spirit of FERC Order 825 – Transient Shortage**

- “We also require that each regional transmission organization and independent system operator trigger shortage pricing for any interval in which a shortage of energy or operating reserves is indicated during the pricing of resources for that interval. Adopting these reforms will align prices with resource dispatch instructions and operating needs, providing appropriate incentives for resource performance.”

- **Adheres to NERC BAL-002 – Reserve Requirements**

- R2. Each Responsible Entity shall develop, review and maintain annually, and implement an Operating Process as part of its Operating Plan to determine its Most Severe Single Contingency and make preparations to have Contingency Reserve equal to, or greater than the Responsible Entity’s Most Severe Single Contingency available for maintaining system reliability.
- R3. Each Responsible Entity, following a Reportable Balancing Contingency Event, shall restore its Contingency Reserve to at least its Most Severe Single Contingency, before the end of the Contingency Reserve Restoration Period (90 mins), but any Balancing Contingency Event that occurs before the end of a Contingency Reserve Restoration Period resets the beginning of the Contingency Event Recovery Period.
- R2 establishes and maintains the reserve requirement while R3 allows for deployment and replenishment of reserves.

- IRD designed to function under status quo and with Reserve Price Formation/ORDC changes.
- Existing penalty factors used during transient shortage conditions.
- Tier 1 and Tier 2 resources are IRD eligible.
  - Updated performance evaluation for Tier 2 cleared resources.
- Static reserve zones for MAD/RTO.
  - IRD deploys reserves with resource specific basepoints that account for active constraints.

- **Tariff Proposed Changes**
  - OATT Attachment K, Appendix, Section 1.11
    - 1.11.4A Synchronized Reserve (c)
    - Details link between IRD cases and Sync Reserve Event initiation
    - Details process when an IRD case is not available
  - OATT Attachment K, Appendix, Section 3.2
    - 3.2.3A Synchronized Reserve (j) and (k)
    - Clarification for Tier 2 credit calculation and shortfall incorporation
    - Tier 2 shortfall aggregation for Demand Resources only
    - Tier 1 MW above Tier 2 MW will be capped
- **PJM Manual Changes will be brought to MRC at a future time**

- Initial phase of 6 to 12 months to start in early 2022.
  - IRD initiated deployments with updated basepoints
  - New performance evaluation based on event dispatch
  - Ensure proper event recovery is achieved
  - Adjust inputs and parameters based on performance
  - Collect data on results to make informed decisions on path forward
- PJM IRD updates will be provided at OC meetings in 2022
  - Review performance metrics and solicit feedback
  - Finalize deployment approach and adjust for upcoming Market changes

- IRD is an out of the box solution that seamlessly integrates into PJM's existing dispatch applications.
  - Highly customizable based on changing conditions and needs
  - Fully optimized SCED solution geared towards deploying reserves
  - Better align dispatch instructions and pricing
- PJM package compatible with existing market constructs and has flexibility to handle market evolutions.
  - Phased implementation and ease of tuning allows for smooth integration with Reserve Market changes

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